

sequence to derogate from the character ascribed to the general motion of the water throughout the strait.

A reference is made to the erroneous opinions which have hitherto been entertained with respect to the motion of the streams of our channels; and the author concludes his paper by explaining his views as to the manner in which the turn of the stream is rendered simultaneous by the rapid rise of the combined wave in the centre of the strait, and expresses a hope that he has satisfactorily shown from the observations, that throughout the English Channel and North Sea the movement of the stream may safely be referred to a common standard. This, it is considered, will be of great importance to navigation; as thus the seaman's progress through these moving waters will be freed from the numerous and perplexing references he was before obliged to make, and which too often—and, it is to be feared, in many instances too fatally—caused the tides to be wholly disregarded. All uncertainty as to the effect of the stream will henceforward, it is expected, be obviated by a simple reference to a tide table.

The paper, which is accompanied by numerous plans and charts, forms a practical illustration of the tidal streams of straits, under the influence of a combined wave.

May 22, 1851.

The EARL OF ROSSE, President, in the Chair.

Edward Schunck, Esq. was admitted into the Society.

Mr. James Smith gave notice, that at the next meeting of the Society he would propose His Grace the Duke of Argyll for immediate ballot, to which as a peer of the realm His Grace is entitled.

The following papers were read:—

1. "Additional Observations on the Diffusion of Liquids." By Thomas Graham, Esq, F.R.S., F.C.S. &c. Received March 27, 1851.

The experiments detailed in this paper were conducted with the same apparatus and in the same manner as those described in the author's two former papers on this subject. The diffusion was generally made from four different proportions of each solution, so as to exhibit pretty fully the character of the salt in reference to this property. The salts operated upon were of two bases only, potash and soda, but the acids were considerably varied, so as to include the hydrates, carbonates, sulphates, sulphites, hyposulphites, sulphovates, oxalates, acetates and tartrates of these bases.

The times chosen for the corresponding potash and soda salts, with the view of obtaining equal diffusions, were always in the proportion of 1.4142 to 1.7320, that is, as the square root of 2 to the square root of 3. Eight cells were diffused of the 1 and 2 per cent. solutions, and four cells of the 4 and 8 per cent. solutions. The salts were always taken anhydrous.

Diffusion of hydrate of potash in 4.04 days at $63^{\circ}4$: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6.56	1.022
" 2 " "	12.84	2.
" 4 " "	25.04	3.900
" 8 " "	52.24	8.137

Diffusion of hydrate of soda in 4.937 days at $63^{\circ}3$: two cells.

	Grs.	Ratio.
From 1 per cent. solution	5.81	1.048
" 2 " "	11.09	2.
" 4 " "	20.86	3.765
" 8 " "	40.44	7.30

The nearest approach to equality of diffusion in the hydrates of potash and soda is exhibited by the 1 per cent. solutions, which are as 6.56 to 5.81, or as 100 to 88.57.

Diffusion of carbonate of potash in 8.083 days, double the time of hydrate of potash, at $63^{\circ}7$: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6.13	1.028
" 2 " "	11.92	2.
" 4 " "	22.88	3.839
" 8 " "	45.44	7.624

Diffusion of carbonate of soda in 9.875 days, double the time of hydrate of soda, at $63^{\circ}4$: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6.02	1.028
" 2 " "	11.70	2.
" 4 " "	21.42	3.661
" 8 " "	39.74	6.792

The diffusion of carbonate of potash appears similar to that of the carbonate of soda in the 1 and 2 per cent. solutions, but they diverge in the 4 and 8 per cent. solutions.

Diffusion of sulphate of potash in 8.083 days at $60^{\circ}3$: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6.16	1.062
" 2 " "	11.60	2.
" 4 " "	22.70	3.914
" 8 " "	43.92	7.572

Diffusion of sulphate of soda in 9.875 days at $59^{\circ}9$: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6.33	1.055
" 2 " "	12.00	2.
" 4 " "	21.96	3.66
" 8 " "	41.38	6.896

The following results of the diffusion of various salts from the 2 per cent. solution were obtained; the times being always 8.083 days for the potash salts and 9.875 days for the soda salts:—

	Grs.	Ratio.
Sulphate of potash at 60°·3 (as above)...	11·60	100·
Sulphite of potash at 59°·5	11·63	100·26
Sulphite of soda at 59°·6 ..	11·83	101·72
Hyposulphite of potash at 59°·8	12·37	106·44
Hyposulphite of soda at 59°·9	11·89	101·10
Sulphovinate of potash at 59°·8	12·60	108·62
Sulphovinate of soda at 59°·6	13·03	
Tartrate of potash at 59°·9	10·96	
Tartrate of soda at 59°·6	10·65	
Carbonate of potash at 59°·9	10·73	
Carbonate of soda at 59°·6	10·65	

Diffusion of oxalate of potash in 8·083 days at 59°·9: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6·20	1·019
" 2 " " "	12·17	2·
" 4 " " "	23·04	3·789
" 8 " " "	42·82	7·042

The oxalate of potash corresponds closely with sulphate of potash.

The diffusion from the 1 per cent. solution of oxalate of soda at 59°·9, gave 6·24 grs. in 9·875 days, or a nearly equal diffusate to that of the oxalate of potash.

Diffusion of acetate of potash in 8·08 days at 60°·3: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6·44	1·028
" 2 " " "	12·52	2·
" 4 " " "	23·44	3·744
" 8 " " "	47·26	7·549

The acetate is found to exceed sensibly the sulphate and oxalate of potash in diffusibility, at the preceding temperature.

Diffusion of acetate of soda in 9·87 days at 59°·6: two cells.

	Grs.	Ratio.
From 1 per cent. solution	6·67	1·070
" 2 " " "	12·46	2·
" 4 " " "	25·04	4·019
" 8 " " "	48·04	7·711

The diffusion of acetate of soda presents a general parallelism to that of acetate of potash for the times chosen, the temperatures of the two series of experiments differing only 0·7 degree.

The salts of potash and soda of the same base appear therefore to give approximately equal amounts of diffusate, when diffused for the two different times chosen, with the remarkable exception of the hydrates of these two bases. The relation is most observable in the small proportions of salt, or weak solutions, such as the 1 and 2 per cent. solutions. The soda salts, as a general rule, fall off in diffusibility in the higher proportions as compared with potash salts.

The double tartrate of potash and soda was observed to undergo decomposition in diffusion, the tartrate of potash separating from the tartrate of soda from the higher diffusibility of the former.